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ABSTRACT

To assess the effects of familiar social stimuli on arousal in a novel and mildly stressful environment, skin conductance was measured in 4-year-old nursery school children who experienced this environment under two conditions: (a) alone, and (b) in the presence of a close friend. The study was intended to test Zajonc's (1965) social facilitation hypothesis that the presence of others as spectators or as coactors enhances the emission of dominant responses, and Berlyne's arousal-reinforcement theory (1967), which implies that the affective consequences of a stimulus will be dependent upon prior level of arousal, Teacher ratings identitied mutual friendships between like-sex children, and these children were paired in the experimental room. Electrodes attached to the fingers continuously measured skin conductance while the children listened to tape recorded sound effects (gong, crashing dishes, barking dogs, etc.) spaced at unpredictable intervals against a background of white noise. Results provided support for the present application of neither Berlyne's nor Zajonc's hypothesis, since significant main effects of the Alone vs. Friend conditions were not found. (NH)

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The Effects of Novel Stimulation on Arousal Level in Young Children Alone and With A Friend

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Traditionally, anxiety has been viewed as a response to stimuli which in the past had been associated with physically painful or noxious states or affairs. Under this model anxiety is controlled by avoiding exposure to the eliciting stimuli. In 1962 Kesson and Mandler defended a "non-traumatic" theory of the origin of anxiety and distress. They also suggest that certain unconditioned stimuli operate to reduce or inhibit distress independently of the stimuli which evoke distress. Among this category of distress inhibitors they include stimulus events such as non-nutritive sucking, rocking, and rhythmical stimulation of various kinds. These distress inhibitors function to inhibit distress irregardless of its source. Kesson and Mandler also view the behaviors of the young child traditionally labeled "separation anxiety" as signs of increased distress which are occassioned by the absence or threatened absence of an important distress inhibitor, the mother.

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King (1966) proposed a theory of infant-mother attachments in mammals and birds which had at its base the ascription to the mother a crucial role as an inhibitor of a particular type of distress, that elicited by novel environments. King proposed that the mother's capacity to reduce the infant's fear in novel situations was related not to the infant's expectations of protection, but rather to the mother's high degree of familiarity as a stimulus complex. According to King, fear is a positive function of the ratio of novel stimulus elements to total stimulus elements in the individual's perceptual field. In a novel field, approaching the mother reduces the effective ratio of novel elements and thereby reduces the infant's fear. Recent reviews by Bronson (1968a, 1968b) support King's assumption that strange stimuli evoke fear in

young children.

King's postulation of a linear functional relationship between novelty and fear is clearly inadequate in view of the abundant evidence that young children are often strongly attracted to novelty. Berlyne (1967) has proposed a theory which, by incorporating the construct of arousal as a hypothetical state variable, accounts for the conflicting data on the relationship between novelty and affect. Berlyne subsumes novelty under the broader category of collative variables. These are stimulus conditions which induce conflict by their inherent incongruity or by their incongruous relation to cognitive structures present in the organism. According to Berlyne's theory novelty and conflict are linearly related to arousal, which, in turn is curvilinearly related to an affect continuum. Low levels of arousal are effectively indifferent, moderate levels yield pleasure (reward) and high levels yield displeasure (punishment). Thus, if one assumes that King was concerned with degrees of novelty which resulted in moderate to high levels of arousal, there is no contradiction between King and Berlyne. A recent study with rats by Sheldon (1969) provided evidence supporting the curvilinear relationship proposed by Berlyne between novelty and the affect continuum.

An important feature of Berlyne's (1967) theory which provides a bridge to the thinking Kesson and Mandler (1961) is Berlyne's proposition that any stimulus condition (internal or external, chemical or mechanical) which influences arousal will be combined in a algebraically additive fashion with the arousing effects of novelty. The resultant arousal level will have the affective consequences indicated above. Therefore, stimulus conditions such as rocking, which Kesson and Mandler refer to as "specific distress inhibitors", may exert their influence on affect indirectly, that is, by altering the individual's level of arousal. The important implication of Berlyne's theory is that the

affective consequences of a specific stimulus condition will be dependent upon the piror level of arousal in the organism. For example, rocking a young child who is only moderately aroused may produce a reduction in pleasure, while on other occasions rocking may reduce distress by lowering arousal levels which are so high as to produce displeasure. Just which specific stimuli will have arousal-reducing or arousal-inducing effects will depend upon the structure of the nervous system and the prior experiences of the organism in question.

Several recent studies provide evidence that the proximity of the mother, a highly familiar stimulus complex, has a distress inhibiting influence upon the infant or young child when he is confronted by novel stimuli (Morgan and Ricciuti, in press; Ainsworth and Wittig, in press; Rheingold, in press).

Such findings may be interpreted in a manner which is consistent with Berlyne's arousal-reinforcement theory (1967). For the young child a stranger or an unfamiliar environment is a novel stimulus which evokes a high level of arousal, accompanied by negative affect. The presence of the mother reduces the total novelty of the situation and thereby reduces arousal. The lower level of arousal would produce an indifferent or rewarding affective state. The present author (Schwarz, 1969) tested the generality of this model with four-year-old children, employing attached peers as the distress inhibitors in a novel environment. Nursery school children were asked to wait in an unfamiliar room either alone, with a strange peer, or with a close peer friend. As predicted, children in the Friend Condition were more motile and were rated as more comfortable than children in either the Stranger or the Alone Conditions by raters who were unaware of the friendship status of the children. These findings were interpreted to indicate that the presence of a highly familiar peer, one with whom the child had been in frequent close association, inhibited

distress in the novel environment.

In an effort to assess more directly the effects of familiar social stimuli on arousal in a novel and midly stressful environment, skin conductance was measured in four-year-old children who experienced this environment under two conditions: (a) alone and (b) in the presence of a close friend. Skin conductance was continuously measured through electrodes attached to the fingers while the children listened through earphones to tape recorded sound effects (gong, crashing dishes, barking dogs, etc.) spaced at unpredictable intervals against a background of white noise. Skin conductance was chosen as the index of arousal because of the extensive evidence that it responds in a predictable fashion to stimulus conditions believed to affect arousal (Berlyne, 1967). By presenting discreet stimilu (the sound effects) and observing the change in skin conductance (GSR) under the two conditions, a rather direct test of Zajonc's (1965) social facilitation hypothesis was possible. Zajonc hypothesized that the presence of others as spectators or as coactors enhances the emission of dominant responses. It could be argued from the Hullian behavior theory that, if activation or drive level is higher in the Friend Condition than in the Alone Condition, subjects in the Friend Condition would show a facilitation of the unconditioned GSR response to the auditory stimuli, since all responses are a multiplicitive function of drive. This "probe-stimulus technique" has been used with considerable success in the assessment of drive level (Brown, Kalish and Barber, 1951; Maryman, 1953). Contrary to Zajonc's position, it was predicted the presence of a friend as a highly familiar stimulus complex would reduce the high level of arousal otherwise elicited by the novel environment of the experiment situation. Therefore, in accordance with Schwarz (1969) application of Berlyne's theory to social attachment phenomena, lower magnitudes of GSR to the startled stimuli and lower levels of prestimulus skin conductance were predicted in

the presence of a friend than when alone in a novel environment.

Subjects

The Ss were drawn from six preschool classes at the Laboratory Nursery School at Liverpool, New York. In each class the head teacher and the assistance teacher were asked to list, independently of each other's judgement, the four best classroom friends of each child and then to rate the degree of closeness of each friendship on the following scale:

A. Often likes to be near this child. If given a choice of partners, would frequently choose this child. Would miss this child if he (she) were absent from school. Would like to spend much of the class day near this child.

B. Frequently spends part of the class day near this child. If given a choice of partners, would occasionally choose this child. May notice this child's absence from school.

C. Doesn't mind being near this child, but would rarely seek him out. Occasionally plays near this child. Would not notice this child's absence from school.

These ratings were used as a basis for identifying like-sex mutual friendship pairs among the children in each class. The minimum criterion for regarding two children as members of a mutual friendship pair was that both teachers list each child as a friend of the other and at least one of the teachers rate each friendship B or higher on the above scale.

The children in the preschool population from which subjects were drawn are regarded as coming from predominately middle class homes. In the Spring when this study was conducted, children ranged in age from 4 to 5½ years. Because of the demands of the nursery school program, the friendship pairs actually participating in the study were selected unsystematically according to availability from the total pool of 30 pairs distributed among morning and afternoon classes.

Apparatus

Subjects were run in a 14x15 foot experimental room located in the same building as the classrooms but in a separate corridor seldom frequented by the children. All children had participated in at least one other experiment conducted several weeks previously in this room (Schwarz, 1969). The room was equipped with one-way windows to permit observation of the children, but otherwise was functionally windowless. The walls were plain and the floor carpeted. The room was lighted at normal levels by recessed overhead fixtures. The only furnishings in the room were two child-size chairs. Each was placed against one of two walls forming a corner of the room, facing away from the wall and four feet from the corner. From this position children seated in the chairs had ready visual access to one another across a distance of about five feet. Cables for two sets of head phones and leads from two sets of electrodes passed beneath a door to an adjacent observation and equipment room.

Two identical and independent systems for recording skin resistence were employed so that two subjects could be tested at once. The systems were alternated between the two treatment sequences with each successive pair of Ss tested. Skin resistance was detected with sets of Grass Type E-1D silver disc electrodes .8 cm. in diameter. Beckman NaCl electrode paste was used as the contact medium. The electrodes were attached to the volvar surfaces of the distal phalanx of the index and ring fin ers of the left hand. Beckman NaCl electrode paste was used as the contact medium. A small bandaid was used to secure the electrode cup to the finger. The leads were also taped with Dermicel at the proximal phalanx to provide strain relief on the electrode contact. As a further precaution, the leads were guided between the fingers to the back of the hand where they were taped again with Dervicel. A 14 volt DC power source (battery) and 2 megohms of resistance in series with the S provided an effective current density of less than 14 microamps/

sq. cm. of electrode surface. The apparatus for recording skin resistance was located in the observation room adjacent to the experimental room and consisted of Beckman Type R Dynograph equipped with event markers and two Beckman bridge circuit couplers (9802 GSR Coupler).

The auditory stimuli were delivered through ear phones by means of a tape recorder. The stimulus tape consisted of seven sound effects spaced at intervals of from 25 to 50 seconds with white noise between stimuli. The auditory stimuli were selected from among those on three commercially available phonograph recordings (Audio Fidelity, Sound Effects Vol. 1 and 2; Realistic, Sound Effects). Tape recordings were made of the sound effects with high fidelity recording equipment and the chosen sound segments were spliced into a tape of white noise at the appropriate intervals. Diverse sounds were employed in an attempt to reduce habituation. Specific sound effects were selected on the likelihood that they would maintain the midly stressful nature on the experimental situation for the duration of the observation period. The sequence of sounds on the resulting stimulus tape is presented in Table 1. To assess the loudness level of the stimuli delivered to the Ss, the stimulus tape, played over the tape recorder and earphones used in the experiment, was evaluated with a Graphic Level Recorder Type 1521-B (General Radio Co.) with the sound level meter set on the C scale (ref. = .0002 dynes/cm^2.) The db level of the initial loudness peak of each stimulus is presented in Table 1. All stimuli except S_5 (Car Skid and Crash) occurred after a 4 second screeching crescendo. The loudness level of the inter-stimulus while remained constant at 44 db. Two copies of the stimulus tape were produced and spliced in tandum with the first copy to create a stimulus tape containing three identical replications of the sound effects.

Design and Procedure

A counterbalanced repeated measures design was employed in which half

of the Ss were administered and two treatment conditions (Alone and Friend) in the sequence Alone-Friend and half in the sequence Friend-Alone. The members of each friendship pair were randomly assigned to the two sequences of treatment.

The female experimenter first ascertained that both members of a friendship pair were available before beginning the experimental procedure with the member of the pair assigned to the Alone-Friend sequence. After getting acquainted, the experimenter told the child that she wanted him to listen to some sounds through earphones. The nature of this communication was varied according to the level of comprehension and cooperation of the child. At the experimental room the child was seated, and the experimenter matter-of-factly explained that she was going to attach wires to his fingers to see how much they would sweat while he listened to the sounds. After the electrodes were attached, the child was asked to keep his hand on his lap and not to play with the wires. Each child was told that he would first hear through the earphones a sound that went "shhhhhhhhhhhh"; that he would hear this sound for a long time and then hear a different noise which was louder, and then hear more of the shhhhh and then some other noises. Next the experimenter explained that she was going to go to another room while he listened to the sounds, but would be back in a little while to ask him what he had heard. Before leaving the first experimenter tested the headphones, a second experimenter in the adjacent observation room started the tape recorder, and the first experimenter adjusted the earphones comfortably for the child and asked him cheerfully to tell her what he heard. Then she left, promising to return shortly. Meanwhile, as soon as the electrodes were in place, the second experimenter in the observation room began balancing the skin resistance bridge in anticipation of the first stimulus which would occur three minutes from the start of the tape recorder. The second experimenter also observed the children through the one-way window and noted

behavior and expression on the polygraph chart. The foregoing describes the Alone Condition as administered in the Alone-Friend sequence.

While the child in the Alone-Friend sequence was listening to the stimulus tape under the Alone Condition, the first experimenter went to the classroom to get the child's friend. Similar instructions were given to this child when he was asked to come to the experimental room.

Following the last stimulus on the tape, the second experimenter stopped the tape recorder and signalled the first experimenter who was waiting in the hall with the second child. They entered the room and the first subject was told that his friend was going to listen to the sounds with him. The second child was seated in the remaining chair and instructed about the electrodes, earphones and sounds in the same manner as the first child had been. In addition, the children were asked not to talk to each other while listening to the sounds. When the electrodes were attached, the second experimenter balanced the other bridge and restarted the stimulus tape. The first experimenter checked and adjusted the earphones for the second child and then departed, promising to return shortly. This paragraph describes the Friend Condition as administered simultaneously to one subject in the Alone-Friend sequence and a second subject in the Friend-Alone sequence.

At the end of the second set of stimuli, the experimenter entered the room, told the first child, who had just completed the Alone-Friend sequence of experimental treatments, that he would now be returning to his room, and told the second child, now halfway through the Friend-Alone sequence, that she wished him to remain a bit longer and listen to some more sounds. After removing the first child's electrodes, the experimenter departed with the first child, promising the second child that she would return shortly. The second experimenter restarted the stimulus tape just before the departure of the first experimenter and the first child and the

second child listened to the set of stimuli once more under the Alone Condition in the Friend-Alone sequence. At the end of the second set, the experimenter detached the electrodes and asked the child what he had heard while enroute back to the classroom, as had been done with the first child.

This procedures was repeated for each mutual friendship pair, with the two children providing the social stimulus context for one another in the Friend condition. For children assigned to the Alone-Friend sequence, the Friend condition was immediately preceded by the Alone Condition. Children assigned to the Friend-Alone sequence began under the Friend Condition and continued immediately thereafter in the Alone Condition.

In all, 14 pairs of children participated in the study. Data on two female Ss one from the Friend-Alone and one from the Alone-Friend sequence, were deleted because of experimenter error. This resulted in a total N of 28, with 13 Ss (7 male and 6 female) under each sequence of treatment conditions.

Results

As indices of arousal level and pre- and poststimulus levels of skin conductance were obtained for each of the 14 stimulus presentation, i.e., the first and second presentations of the series of seven sound effects. The prestimulus level of skin conductance was measured at the onset of the stimulus and the poststimulus level was read at the highest level of skin conductance within 15 seconds of the onset of stimulation. Skin resistance (R) directly measured in ohms was converted to log microohms of skin conductance (SC) by the following formula: $SC = \text{Log} \left(\frac{1}{R} \times 1{,}000{,}000\right)$. A third measure, which was used as an index of drive and arousal, was equivalent to a GSR: the poststimulus skin conductance score (Post SC) was subtracted ffom the prestimulus skin conductance score (Pre SC) for each stimulus presentation. Thus the GSR score represented the change

in skin conductance accompanying the presentation of a sound-effect stimulus.

Each of these measures, Pre SC, Post SC, and GSR, were analyzed in a repeated measures analysis of variance design which consisted of two between subject factors, Sex (Male vs. Female) and Sequence (Alone-Friend and Friend-Alone), and two within subjects factors, Treatment (Alone vs. Friend) and Trials (S_1 through S_7).

The mean GSR scores fro male and female subjects in the two sequences of treatment order are plotted in Figure 1 as a function of stimulus presentations. Period I represents the first presentation of the sound effect series and Period II represents the second presentation of the series. The summary of the analysis of variance of GSR scores is presented in Table 2. As can be seen in Figure 1, all groups show a typical habituation pattern which is most marked in Period I and also visible in Period II. It is this effect which was reflected in the significant main effect for Trials. In general the GSR to S_1 which followed three minutes of white noise was the strongest GSR in Periods I and II. Interactions incorporating both the Treatments (B) factor and the Sequence (C) factor reflect what is mathematically equivalent to a Periods effect. Thus, the Treatments X Sequence Interaction, which approaches significance, indicates that there was a trend toward larger GSR scores to S_1 in Period I than in Period II. Contrary to prediction, the main effect of treatment conditions, Friend vs. Alone, was not significant. Hence, the results with the GSR score failed to support the prediction of a higher arousal level when alone than when with a friend.

Figure 2 presents the means of Pre SC scores for males and females under the two sequences of treatment plotted as a function of the trials in Periods I and II. The analysis of variance of these data, also presented in Table 2, indicated that there was a significant interaction

between Sex and Sequence. As seen in Figure 2, the Pre SC level was higher for males in the Friend-Alone sequence and for females in the Alone-Friend sequence. No other effects were statistically significant. The lack of significant differences on the Treatment factor fails to support the hypothesis of higher arousal level in the Alone Condition.

The means for Post SC scores are presented in Figure 3. As with the Pre SC score, the Sex X Sequence interaction for Post SC scores was statistically significant, and the same pattern of differences was observed as with the Pre SC scores (see Table 2). Males in Friend-Alone sequence and Females in the Alone-Friend sequence had higher Post SC scores. The trials effect and the interaction of Trials with Periods were statistically significant, findings which parallel the GSR results. The predicted main effect of Treatment was not significant. However, there was one trend in Post SC scores which was in the direction of the hypothesis of Lower arousal in the Friend Condition. Post SC scores tended to drop more from the first to the last trial for both males and females in the Alone-Friend sequence ($\bar{X}$ = .093) than in the Friend-Alone sequence ($\bar{X}$ = .024). Although the difference between these means was not statistically significant (F = 1.89, df = 1/22), the trend suggested the possibility of greater habituation or reduction in arousal in the Alone-Friend sequence.

A marked contrast in effect was observed for subjects under the Friend condition as compared with the Alone condition. When alone many subjects appeared unhappy and tense; none laughed. When with the friend, 15 of the 26 subjects laughed. The laughter was most often in response to the presentation of a sound-effect stimulus.

Discussion

The results obtained with skin conductance indices of arousal and d ive provided support neither for the present application of Berlyne's (1967) novelty-arousal hypothesis nor for Zajonc's (1965) social facilita-

tion hypothesis, since significant main effects of the Alone vs. Friend Conditions were not found. The negative implications of these findings are greater for Zajonc's hypothesis than for the novelty-arousal hypothesis. Many more assumptions about the nature of the experimental context were required in order to make predictions from the novelty-arousal theory than to make predictions from Zajonc's hypothesis. Zajonc (1965) postulated that the mere presence of others as spectators or coactors enhances the emission of dominant responses. The presence of a friend undergoing the same experimental procedures certainly fits the requirements of a coactor; however, the amplitude of the GSR to auditory stimuli was not higher in the presence of the friend. In the case of the novelty-arousal theory; it is assumed that the friend, because of his high familiarity as a stimulus complex, will reduce the total novelty of the stimulus context, assuming that the situation is highly novel. It is possible that, because of the fixed position of the subjects and the delivery of the stimuli through earphones, the presence of the friend had relatively little impact on the novel and arousing properties of the experimental situation. More direct interaction or more extensive mutual response elicitation may be required before the proximity of a friend will significantly reduce arousal. Greater interaction was possible in the study by Schwarz (1969) which supported the novelty-arousal hypothesis. The observation of more frequent laughter in the Friend Condition was also congruent with Schwarz 1969 study, in which effect was found to be more strongly positive in the presence of a friend than when alone or with a stranger in a novel situation.

As noted in the results, there was a nonsignificant trend for subjects in the Alone-Friend sequence to end the sequence with lower levels of Post SC than subjects in the Friend-Alone sequence. Such a trend is encouraging and worthy of further investigation, especially in view of the small sample available for this preliminary investigation. The slope of the Post SC

curves in Period II suggests that a longer duration in the experimental treatment conditions, achieved by lengthening the interstimulus intervals, might augment these differences. Unfortunately, increasing the duration of the session may have the effect of reducing novelty and increasing other sources of arousal such as fear of abandoment,

The meaning of the interaction between sex and sequence in the Pre and Post SC scores was unclear. The significance level of this interaction indicated that it would occur by chance one time in a hundred. This could have been that one time. Since GSR is a function of prestimulus level of skin conductance, such differences complicate the interpretation of GSR data. A post hoc attempt to account for this finding as a consequence of the experimental treatments must assume that the social context of Period I had such a powerful effect that it continued, unabated through Period II, despite the fact that the treatment conditions were reversed. Secondly, it must be assumed that males and females reacted oppositely to a highly novel situation when alone than when in the presence of a friend. In view of the tenuous nature of these assumptions, further attempts at explanation should await replication.

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Footnote

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